CLAIMS

1. A semiconductor layer having a double hetero mesa-stripe serving as a first semiconductor laminated product including at least a quantum well active layer formed by selective growth on a semiconductor substrate, and recombined layers serving as second semiconductor laminated products simultaneously formed on both the sides of the double hetero mesa-stripe at a predetermined interval in the selective growth, wherein

when an average strain amount ε (average) and a critical strain amount ε (critical) are defined by the following equations:

[Equation 1]

$$\varepsilon\ (\text{average}) = \frac{\sum_{i=1}^{n} (\varepsilon i \times di)}{d} \qquad d = \sum_{i=1}^{n} di$$

where the number of strained semiconductor layers is represented by j, the number of unstrained semiconductor layers sandwiched by the strained semiconductor layers is represented by k, and a strain amount of an i-th semiconductor layer and a thickness of the i-th semiconductor layer in the double hetero mesa-stripe or the recombination layers obtained by laminating n (n = j + k) semiconductor layers are represented by ε i and di, respectively,

[Equation 2]

$$\varepsilon\ (\text{critical}) = \frac{b}{4\pi d} \cdot \frac{(1 - p \cdot (\cos\alpha)\hat{}2)}{(1 + p) \cdot \cos\lambda} \cdot \{\ln(\frac{4d}{b}) + 1\}$$

where

b: Strength of Burgers vector,

p: Poisson's ratio

α : angle between a dislocation line and its Burgers vector

λ : angle between a slip direction and a direction perpendicular to cross lines of a slip surface and a laminate surface and being in the laminate surface,

an average strain amount ε 1 (average) of the double hetero mesa-stripe is a compression strain (ε 1 (critical) $\geq \varepsilon$ 1 (average) > 0, and

an average strain amount ε 2 (average) of the recombination layer is a tensile strain ($-\varepsilon$ 2 (critical) $\leq \varepsilon$ 2 (average) < 0) not more than a critical strain amount ε 2 (critical) or zero strain (ε 2 (average) = 0).

2. The semiconductor laser according to claim 1, wherein the selective growth layer includes at least a optical confinement layer and a quantum well active layer.

3. The semiconductor laser according to claim 1 or claim 2, wherein the selective growth layer contains AlInAs or AlGaInAs.

4. The semiconductor laser according to any one of claims 1 to 3, wherein a distance between the double hetero mesa-stripe and the recombination layer is 15 μ m or less.

5. A method of manufacturing a semiconductor laser comprising: the step of forming a pair of stripe-shaped dielectric masks on a semiconductor substrate; the step of forming a double hetero mesa-stripe serving as a first semiconductor laminated product including an active layer in a narrow

portion sandwiched by the dielectric masks; and the step of, at the same time, forming recombination layers serving as second semiconductor laminated products in broad portions on both the outsides of the dielectric masks, wherein

when an average strain amount ε (average) and a critical strain amount ε (critical) are defined by the following equations:

[Equation 3]

$$\varepsilon\ (\mathrm{average}) = \frac{\sum_{i=1}^{n} (\varepsilon i \times di)}{d} \qquad d = \sum_{i=1}^{n} di$$

where the number of strained semiconductor layers is represented by j, the number of unstrained semiconductor layers sandwiched by the strained semiconductor layers is represented by k, and a strain amount of an i-th semiconductor layer and a thickness of the i-th semiconductor layer in the double hetero mesa-stripe or the recombination layers obtained by laminating n ($n = j + k$) semiconductor layers are represented by ε i and di, respectively,

[Equation 4]

$$\varepsilon\ (\mathrm{critical}) = \frac{b}{4\pi d} \cdot \frac{(1 - p \cdot (\cos\alpha)\hat{\ }2)}{(1+p) \cdot \cos\lambda} \cdot \{\ln(\frac{4d}{b}) + 1\}$$

where

b: Strength of Burgers vector,

p: Poisson's ratio

α : angle between a dislocation line and its Burgers vector

λ : angle between a slip direction and a direction perpendicular to cross lines of a slip surface and a laminate surface and being in the laminate surface,

an average strain amount ε 1 (average) of the double hetero mesa-stripe is a compression strain (ε 1 (critical) $\geq \varepsilon$ 1 (average) > 0, and

an average strain amount ε 2 (average) of the recombined layer is a tensile strain ($-\varepsilon$ 2 (critical) $\leq \varepsilon$ 2 (average) < 0) not more than a critical strain amount ε 2 (critical) or zero strain (ε 2 (average) = 0).

6. The method of manufacturing a semiconductor laser according to claim 5, wherein the selective growth layer includes at least a optical confinement layer and a quantum well active layer.

7. The method of manufacturing a semiconductor laser according to claim 5 or claim 6, wherein the selective growth layer contains AlInAs or AlGaInAs.

8. The method of manufacturing a semiconductor laser according to any of claims 5 to 7, wherein a distance between the double hetero mesa-stripe and the recombination layer is larger than 0 and nor more than 15 μ m.